An-Najah National University

Faculty of Engineering and Information Technology

Computer Engineering Department

Graduation Project 2

“Gesture control car”

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Presented in partial fulfilment of the requirements for a bachelor’s degree in computer engineering.

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Disclaimer

This report was written by two students in the College of Engineering Department of Computer Engineering: Mahmoud Basha and Mustafa Hab-Romman.

All results written in this report are prepared by the two students and no results from external sources were used.

Table of Contents

Abstract

An automobile with gesture control can be manoeuvred forward, backwards, right, or left by using hand motions.

This type of control is also used by people with mobility challenges who find it difficult to travel everywhere also to deliver goods to remote regions that would be dangerous for someone to access on their own.

The car was linked from the front with a handle for the possibility of retrieving items and with a camera to stream the road in this project. Several motors were connected through a motor driver installed on the body of the car, where it receives commands from a piece of ESP32 connected with another piece similar to it on the glove.

1. Introduction

1.1. General background

A vehicle classified as a gesture-control car uses gesture recognition technology to operate and control its various systems. Gesture control enables the driver to communicate with the vehicle using hand gestures rather than more conventional controls like buttons, switches, or steering wheels.

Gesture control technology typically relies on sensors, cameras, or other motion-tracking devices to detect and interpret
the user's gestures.

Overall, gesture control in cars represents an innovative approach to human-machine interaction.

1.2. Objectives and Scope

1.2.1. One of the main goals is to give drivers and passengers a more intuitive and user-friendly experience.

1.2.2. greater safety for people who work in risky situations and have to reach lots of distant objects.

1.2.3. a wider spectrum of people, especially those with mobility disabilities, to use the car's functions comfortably and independently.

1.2.4. Smart sensing capabilities, sensors like accelerometers are capable of detecting minuscule vibrations that are so small that people are unable to even notice them. It can tolerate between 5% and 10%. As a result, the tool operates very precisely and can be applied to tasks where mistakes must be avoided at all costs.

2. Constraints and Earlier Coursework

2.1. Constraints

2.1.1. Inaccuracy in hardware modules: Some hardware components, such as motors and mpu6050, have accuracy issues. As a result, the car occasionally moves with a certain amount of error.

2.1.2. High-cost components: We needed very accurate hardware, which turned out to be very expensive, to produce accurate output. Consequently, our hardware models ended up being less accurate like mpu6050 and dc motors.

2.2. Earlier Coursework

2.2.1. Microcontrollers and PIC: the basics of Arduino like I/O, serial communication and servo motor programming helped from these courses.

2.2.2. Networks: we learned about IP, MAC address, peer-to-peer connection, and wireless communication in this course which helped in making connections with the two ESP modules.

2.2.3. Critical Thinking and Research Skills: This course helped us write this report

2.2.4. CPU and electronic circuit course: we learned to connect multiple parts and wire them with the correct inputs and outputs.

2.2.5. Programming courses: like C++ and OOP helped us write clean and easy-to-modify code.

3. Literature review

Gesture-controlled car projects have gained significant interest in recent years due to their potential to revolutionize mobility options for individuals with mobility challenges and their ability to navigate remote and inaccessible regions.

Hardware Design:

Several studies have focused on the hardware design aspects of gesture-controlled car projects. Researchers have explored the integration of microcontrollers, motor drivers, DC motors, ultrasonic sensors, servo motors, cameras, and other components to build a robust and reliable vehicle. These studies emphasize the importance of selecting appropriate hardware components and optimizing their integration for smooth and precise control.

3.1. Control Mechanisms:

Control mechanisms play a vital role in gesture-controlled car projects. Researchers have explored various techniques such as gesture recognition using sensors like accelerometers, gyroscopes, and flex sensors. These studies have investigated algorithms for translating hand motions into specific commands for controlling the car's movements. The integration of control algorithms and software development has been a key focus to ensure accurate and responsive control of the vehicle.

3.2. Obstacle Detection and Avoidance:

Efficient obstacle detection and avoidance are crucial for safe navigation in gesture-controlled car projects. Researchers have employed ultrasonic sensors to detect obstacles and provide real-time feedback to the user. These studies have explored algorithms for obstacle detection, path planning, and collision avoidance, ensuring the car can navigate its environment safely.

3.3. Vision technology:

Having vision around you is very important in gesture-controlled cars.
Experts have created a variety of modules to provide cameras with a lot of functionality like streaming, capturing and detection

3.4. User Experience:

The user experience aspect of gesture-controlled car projects has been a subject of research interest. Studies have examined the development of user-friendly interfaces, intuitive controls, and feedback mechanisms to enhance the overall user experience.

4. Methodology

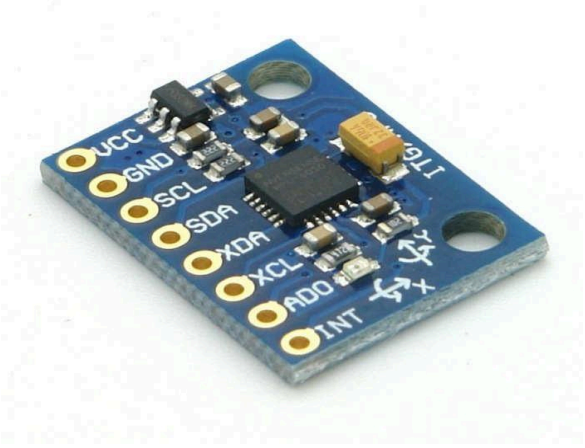
This section is intended to show detailed information about the parts, methods and techniques used to develop the car.

4.1. Hardware communication

To make wireless communication between the hand and the car we used ESP32 since it can create a peer to peer communication between two ESP32s and send various data types, we used esp_now and wifi library to make the communication.

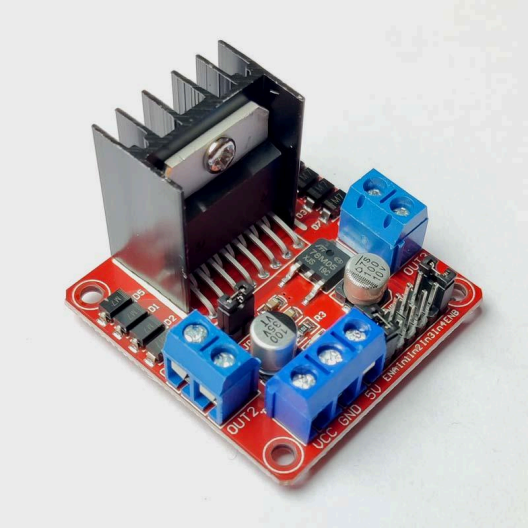
4.2. Movement Detection

For controlling the car we need to send some type of data, as we use hand gestures and position to control it we need some type of position sensor, we used MPU6050 to get hand gestures using the IC2DEV and MPU6050 library to read data and then send it through ESP32.



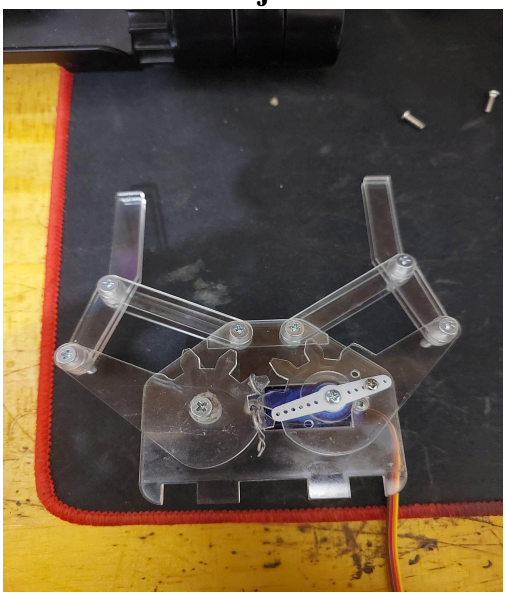
4.3. Car movement

To control the car movement we send the received data from the ESP32 initialized on the car body with the motor driver(H-Bridge), and then the motor driver controls the dc motors as needed.



4.4. Grabbing objects

We use a handle with a servo motor in the front to grab small objects, the servo grab mechanism works with a flex sensor when we bend the flex sensor the resistance increased so the servo moves to make the handle close on the object.



4.5. Vision and Detection

We use multiple ways of detection, we added a camera to the car (ESP32-CAM) to stream what is in front of the car and we use an ultrasonic sensor to detect the objects behind the car with a buzzer that will increase in frequency as it gets closer to an object behind it, we used async TCP and ESPAsync libraries to stream locally on a web server and control LED.

5. Results and Discussions

A Gesture control car project presents a preliminary system for dealing with cars using gestures, the advantages of which lie in

- **Ease of using the car for different categories.**
- **Car access to dangerous places.**
- **The (relatively) low cost of the car.**
- **Easy to program the car and connect it with the hand.**
- **Easy and Flexible System.**

6. Conclusion and Recommendations

Controlling the car through gestures will become one of the most popular ways to control cars because of their ease of use and several features that were mentioned earlier.

It is also working on this project that increases our skills and understanding of some hardware and control issues, and how to deal with different sensors and choose the best parts to fit the need of the project.

7. References

1. https://randomnerdtutorials.com/esp-now-esp32-arduino-ide/

2. https://www.researchgate.net/publication/362264272_Accident_Detection_and_Alerting_Systems_A_Study